# PATENT ABSTRACTS OF JAPAN

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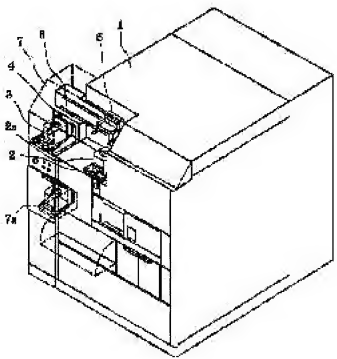
(72) Inventor : **YAMADA KOHEI**

(54) **SEMICONDUCTOR MANUFACTURING APPARATUS**

(57)Abstract:
PROBLEM TO BE SOLVED: To minimize the reticle replacing time by placing at least an SMIF indexer at a reticle transfer height enough to take out a substrate from an SMID pod with its door opened to carry the pod between the indexer and mount. SOLUTION: A reticle SMIF indexer 2 is disposed at a front left part of an aligner chamber 2 and its pot mounting face is higher by a given amount from the reticle transfer height. At a front left part of the chamber 1 a pot mount 3 and mount lift 4 to move the mount 3 up and down from near a height of 800mm above the floor to near the pod mount face height of the indexer 2. Above the indexer 2 and lift 4 a robot hand 5 and vertically and horizontally moving means 6 are disposed to thereby minimize the reticle replacing time and reticle contamination during carrying.



* NOTICES *



## CLAIMS

[Claim(s)]
[Claim 1]A stowage container in which opening and closing for keeping pure a cassette having at least one substrate and this board characterized by comprising the following are possible and which was sealed mostly, and a semiconductor manufacturing device provided with at least one set of a stowage container opening and closing means which performs opening and closing of this stowage container.
a mounting base for being in a different position from this opening and closing means, and carrying out carrying-in appearance of this stowage container to this manufacturing installation.
A transportation means which conveys this stowage container between a carrying-in appearance position of this mounting base, and an opening and closing position of this opening and closing means.

[Claim 2]The semiconductor manufacturing device according to claim 1, wherein a stowage container carrying-in appearance position of said mounting base is one of positions lower than an opening and closing position of said opening and closing means.
[Claim 3]The semiconductor manufacturing device comprising according to claim 1:
An ascending and descending means which said transportation means makes go up and down [ to / from container carrying-in appearance height / near the stowage container opening-and-closing height ] said mounting base.
A hand which grasps a stowage container laid on this mounting base near [ stowage container opening-and-closing height ] this, or said stowage container opening and closing means.
A hand ascending and descending means which goes up and down this hand.
A horizontal migration means to which horizontal migration of this ascending and descending means is carried out between this mounting base and this stowage container opening and closing means.

[Claim 4]The semiconductor manufacturing device according to claim 1 operating only when said mounting base has two or more existence sensors which detect that a stowage container is laid and one of these the sensors has this stowage container in a regular position.
[Claim 5]The semiconductor manufacturing device according to claim 1, wherein said stowage container has a bar code or a means of communication of ID which can be read and has an

information reading means which can read this ID when this stowage container is laid at least on said mounting base in said container carrying-in appearance position.
[Claim 6]The semiconductor manufacturing device according to claim 1, wherein environment in said semiconductor manufacturing device and environment of conveying space of said stowage container are separated mostly.
[Claim 7]The semiconductor manufacturing device according to claim 1, wherein a substrate by which is stored in said stowage container and carrying-in appearance is carried out to the semiconductor manufacturing device concerned is reticle.
[Claim 8]The semiconductor manufacturing device according to claim 1 establishing an exhaust means which covers conveying space of said stowage container with covering, and exhausts this inside of conveying space.
[Claim 9]A semiconductor device manufacturing using the semiconductor aligner according to any one of claims 1 to 8.

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[Translation done.]

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the semiconductor manufacturing device which has a standard mechanical interface (SMIF) pod transportation means. Namely, the stowage container (it is henceforth called a SMIF pod for short) which can be opened and closed and which can keep pure the cassette having substrates, such as a semiconductor wafer and reticle, is used, It is related with the semiconductor manufacturing device what is called corresponding to a SMIF system which supplies and collects substrates to semiconductor manufacturing devices, such as an exposure device.
[0002]
[Description of the Prior Art]Conventionally, in the manufacturing process of a semiconductor, especially the lithography process, in order to raise the yield, substrates, such as a semiconductor wafer, have been processed in the clean room which managed the dust of the submicron size leading to an element defect. However, the clean room which manages the still smaller dust of particle diameter corresponding to these has technical realization, or is becoming difficult in cost today when high integration of an element and the minuteness making of the circuit are progressing. For this reason, an inside stores the cassette which contained the substrate as one of the methods of replacing with the improvement in an air cleanliness class of a clean room to the well-closed container which can be opened and closed and which was kept pure, The standard mechanical interface which enables clean conveyance of a substrate, and what is called a SMIF system are proposed by giving the opening and closing means of this container to each manufacturing installation.
[0003]Then, if SMIF correspondence of reticle carrying-in appearance is considered, for example in a semiconductor aligner, it will become like drawing 6 and drawing 7. Namely, the opening-and-closing ascending and descending means 103 (it is henceforth called an SMIF indexer for short) which pulls out the reticle career (cassette) 103a which this semiconductor aligner opened and closed the SMIF pod 102, and was stored from this pod 102, The hand 104 of the letter of a fork holding the reticle for taking out the reticle 102b from the cassette 102a pulled out in the semiconductor aligner 101 by this SMIF indexer 103, It becomes the thing provided with the transportation means 105 which conveys this hand 104 to an

unillustrated PURIARAIMENTO stage while **(ing) to this cassette 102a and going up and down approximately. And if the contamination of the reticle 102b and the swap time of the reticle 102b which are conveyed by this transportation means 105 are taken into consideration, when taking out the reticle 102b from the cassette 102a, height coincides the reticle 102b with the height conveyed to a PURIARAIMENTO stage mostly, The conveyance system way should be made into the shortest. In order to do so, the pod mounting surface of SMIF indexer 103 will be arranged from a reticle conveyance face in the upper part for how many minutes. And since reticle conveyance height is near the reticle stage height of an exposure device, it is set to not less than 1600 mm from a floor.

[0004]

[Problem(s) to be Solved by the Invention]However, supply recovery of the pod by the owner orbital automatic guided vehicle (it is henceforth called AGV for short) which runs the pod exchange and the floor line by an operator in the above arrangement since the mounting surface of a pod is high is difficult, While use of AGV which runs the orbit hung from the ceiling of the clean room becomes indispensable and raising facility cost, the restrictions on a layout also increase.

[0005]In order to correspond to the pod exchange and floor line run AGV by an operator on the other hand, when the position of an indexer is set as a height of 800-1000 mm from a floor line, Since the distance which conveys reticle within the pure environment in a semiconductor manufacturing device increases substantially, There is a possibility of polluting pure environment and reticle by the raising dust from the transporting mechanism part, In order to prevent it, it is necessary to restore the large-scale measure against raising dust, for example, the taken-out reticle, to another cassette with a lid, and to convey it to it, or to make each actuator into the combination of a turning arm, and it necessary to suppress raising dust. When the reticle of two or more sheets is stored in a pod, there is a fault of increasing the time which reticle replacement takes.

[0006]Then, the purpose of this invention is to provide the means which makes contamination and swap time of a housed article the minimum in the semiconductor manufacturing device corresponding to a SMIF system, and enables exchange of the pod by an operator or floor line AGV.

[0007]

[Means for Solving the Problem]Height which was suitable for pod carrying-in appearance while having arranged one or more sets of SMIF indexers so that height when taking out a substrate which opened an opening and closing door of a SMIF pod in a semiconductor manufacturing device, and was stored in this invention in inside may turn into reticle conveyance height mostly in order to attain the above-mentioned purpose, for example, a mounting base for carrying out carrying-in appearance of the pod to a height of about 900 mm from a floor line was formed, and it had a transportation means which conveys a pod between this SMIF indexer and this mounting base

[0008]

[Function]Since the position of the SMIF indexer is made mostly in agreement [ height when taking out reticle from a pod ] with a reticle conveyance face according to this, The course which conveys the reticle taken out from the pod to a PURIARAIMENTO stage serves as the

shortest, and while being able to make reticle replacement time into the shortest, contamination of the reticle under conveyance is also made to the minimum. Since the carrying-in appearance position of the pod was established apart from the indexer, the height can be made into arbitrary about height, for example, 900 mm, and the pod exchange by an operator and the correspondence to floor run AGV also become easy. A pod conveying path is covered with covering, since it is separable with the pure environment and clean room environment in a semiconductor manufacturing device by exhausting an inside, raising dust preventive measures become unnecessary at a pod conveyer style, and a system can be cheaply manufactured now.

[0009]

[Example]Drawing 1 is a bird's-eye view of the whole semiconductor aligner concerning one example of this invention. there is SMIF indexer 2 for reticles in the front left upper part of the exposure device chamber 1 -- the pod mounting surface -- the conveyance height of reticle -- the specified quantity -- it is set up highly. On the other hand, the mounting base ascending and descending means 4 which makes the pod mounting base 3 and this mounting base 3 go up and down [ to / from the 800-mm-high neighborhood / from a floor line / near the pod mounting surface height of this indexer 2 ] is allocated in the front left of this chamber 1. Above this indexer 2 and this mounting base ascending and descending means 4, it has the upper and lower sides and the rise-and-fall horizontal migration means 6 for carrying out horizontal migration for the robot hand 5 and this hand 5 which grasp the member for handling formed in the pod 2a. This robot hand 5 and this rise-and-fall horizontal migration means 6 are constituted by a publicly known mechanism, for example, a pulse motor, a ball screw, the linear guide, etc. It is covered with the covering 7 and dissociates from both the pure environment in an exposure device, and the environment in a clean room, and the aforementioned mechanism part and the conveyance area of a pod pollute both the aforementioned environment, when exhausted by the unillustrated exhaust means. 7a is the door provided in the covering 7 in order to carry out carrying-in appearance of the pod 2a to the mounting base 3.

[0010]Next, the top view of drawing 2 and the sectional view of drawing 3 explain the composition of the circumference of the pod mounting base 3 in pod 2a carrying-in appearance height. When the three gage pins 8 and the pod 2a which fit into the hole for positioning established in the bottom of the eight guide pins 9 which guide the outside of the pod 2a roughly on the pod mounting base 3, and the pod 2a, and determine the position of a pod are laid in a regular position. It has the first existence detection sensor 10 that detects it. The first existence detection sensor 10, When the shade part which the pin 10a energized up by the flat spring 10b fixed to the rear face of the mounting base 3 was depressed by the pod 2a bottom, and provided one end in the other end of the flat spring 10b shades the photo interrupter 10c, it detects that the pod was laid in the regular position. On the other hand, the second existence detection sensor 12 (12a, 12b) detected with a transmission type sensor is attached [ whether the pod mounting base 3 is being fixed on the boarding ramp 4a of the mounting base ascending and descending means 4, and the pod 2a is on the mounting base 3 on the boarding ramp 4a or there is nothing, and ]. Detection of the pod which is not in a regular position is enabled by these two existence sensors 10 and 12.

[0011]It communicates with the ID means of communication 13 provided in the pod 2a in pod carrying-in appearance height to the base part of the mounting base ascending and descending means 4, and the ID reading means 11 which reads ID information is attached.
[0012]when the door 7a for carrying out carrying-in appearance of the pod 2a to the mounting base 3 is formed in the pod carrying-in appearance height of the covering 7 and the mounting base 3 is not [ installation height (lower position) ] alike according to an unillustrated locking mechanism, the door 7a opens.
[0013]Next, the flow chart of drawing 4 and drawing 5 explains the motion at the time of unloading at the time of loading of a pod. An operator sets the pod 2a to the pod mounting base 3, and loading operation shuts the pod placing part door 7a, and starts it by carrying out the depression of Rhodes Izzi who is not illustrated in the door 7a upper part. It checks that another pod does not already exist with reference to drawing 4 on the indexer 2 which should be loaded as a check of whether to be in the state where the set pod 2a can be conveyed first, or the pod carrier robot 5 an unillustrated proximity sensor or on soft. If the alarm 1 is emitted and the existing pod is not unloaded to an operator when another pod exists on the indexer 2 or the pod carrier robot 5 here, it tells that the following pod cannot be loaded, and loading operation is stopped. On the other hand, if it is checked that loading is possible, it will check that the pod 2a is set to a regular position by the first existence sensor 10, and in the case of NG, the alarm 2 is emitted like the above, and, as for the case of O.K., ID of a pod is read by the ID reading means 11. Collation with ID read here and ID beforehand set in the manufacturing installation is performed, and it checks that it is a pod which should be loaded. When the mistaken pod is set, the alarm 3 is emitted, and loading operation is stopped.
[0014]When all the above checks are O.K., actual conveying operation is started. First, after locking the pod placing part door 7a in open impossible for safety, the mounting base 3 is moved to an upper position by the ascending and descending means 4. Next, it is made to descend to pod grasping height by the hand rise-and-fall horizontal migration means 6 with the state where the robot hand 5 was opened, the robot hand 5 is closed, and the pod 2a on the mounting base 3 is grasped. The after-check robot hand 5 is raised and it moves that the pod 2a was grasped normally to the upper part of the indexer 2. And the robot hand 5 is dropped, the robot hand 5 is opened in the place where the pod 2a was laid on the indexer 2, and the pod 2a is released. The robot hand 5 is raised after checking that the pod 2a has been normally laid on the indexer 2 here, and it moves to the pod mounting base 3 upper part. And as the pod 2a is grasped, the lock of a pod base lid is canceled and it is shown in drawing 7, in a manufacturing installation, the indexer 2 pulls out the cassette 102a in the pod 2a, and completes loading operation. What is necessary is just to convey the reticle 102b in the cassette 102a on a PURIARAIMENTO stage henceforth by the known reticle transportation means 104,105 which was described by the conventional example.
[0015]Unloading operation is similarly started by carrying out the depression of the unloading switch which has an operator near [ said ] Rhodes Izzi. It checks that other pods which the pod 2a which should be unloaded is on the indexer 2 first with reference to drawing 5, and bar unloading on the pod carrier robot 5 and the pod mounting base 3 cannot be found an unillustrated proximity sensor or on soft, and checks by the second existence sensor 12. When set to NG by either, the alarms 4 and 5 corresponding to each are emitted, and unloading

operation is stopped.

[0016]When all the above checks are O.K., actual conveying operation is started. First, after locking the pod placing part door 7a, the pod mounting base 3 is moved to an upper position by the ascending and descending means 4. Next, if it checks that the reticle 102b taken out from the cassette 102a of drawing 7 is altogether stored by the cassette 102a and there is the reticle 102b which is not stored, it will store to the cassette 102a by said reticle transportation means 104,105. If all the reticles 102b are stored, the cassette 102a will be stored to the pod 2a with the indexer 2, a base lid is locked, and the restraint of the pod 2a is canceled. And it is made to descend from the upper position of the indexer 2 to pod grasping height with the state where the robot hand 5 was opened, the robot hand 5 is closed, and the pod 2a on the indexer 2 is grasped. The robot hand 5 is raised after checking that the pod 2a has been grasped normally, and it moves to the mounting base 3 upper part. And the first existence sensor 10 opens after a check and the robot hand 5 for having made it descend again and the pod 2a having been normally laid on the pod mounting base 3, the pod 2a is released, and the robot hand 5 is moved to the upper part of the pod mounting base 3. If movement of the robot hand 5 is completed, the pod mounting base 3 will be moved to a lower position from an upper position, the lock of the pod placing part door 7a is canceled, and unloading operation is ended.

[0017]Loading in case the above carries out supply recovery of the pod 2a with an operator, Although it is unloading operation, supply recovery of the pod 2a by floor line run AGV is also attained by replacing with the pod placing part door 7a and a load unloading switch in the above, and having a known wireless communication means and positioning mark.

[0018]Although this example has explained pod conveyance to one set of an SMIF indexer, if the larger elevating length of said hand rise-and-fall horizontal migration means 6 than a pod 2a overall height size is taken, conveyance to two or more SMIF indexers is possible, It cannot be overemphasized that it may convey to two or more exposure devices. Although the pod mounting base and the ascending and descending means were made into an exposure device and another structure, they are good also as an exposure device and integral construction.

[0019]

[The example of a device production method] Next, the example of the production method of the device using the exposure device or exposure method which explained [ above-mentioned ] is described. Drawing 8 shows the flow of manufacture of minute devices (semiconductor chips, such as IC and LSI, a liquid crystal panel, CCD, a thin film magnetic head, a micromachine, etc.). The design pattern of a device is performed at Step 1 (circuit design). The mask in which the designed pattern was formed is manufactured at Step 2 (mask manufacture). On the other hand, at Step 3 (wafer manufacture), a wafer is manufactured using materials, such as silicon and glass. Step 4 (wafer process) is called a previous process, and forms a actual circuit on a wafer with a lithography technology using the mask and wafer which prepared [ above-mentioned ]. The following step 5 (assembly) is called a post process, is a process semiconductor-chip-ized using the wafer produced by Step 4, and includes processes, such as an assembly process (dicing, bonding) and a packaging process (chip enclosure). At Step 6 (inspection), the operation confirming test of the semiconductor device produced at Step 5, an endurance test, etc. are inspected. A semiconductor device is

completed through such a process and this is shipped (Step 7).

[0020]Drawing 9 shows the detailed flow of the above-mentioned wafer process. The surface of a wafer is oxidized at Step 11 (oxidation). An insulator layer is formed in a wafer surface at Step 12 (CVD). At Step 13 (electrode formation), an electrode is formed by vacuum evaporation on a wafer. Ion is driven into a wafer at Step 14 (ion implantation). A sensitizing agent is applied to a wafer at Step 15 (resist process). At Step 16 (exposure), printing exposure of the circuit pattern of a mask is carried out at a wafer with the exposure device which has the pod conveying machine which explained [ above-mentioned ]. The exposed wafer is developed at Step 17 (development). At Step 18 (etching), portions other than the developed resist image are shaved off. The resist which etching could be managed with Step 19 (resist removing), and became unnecessary is removed. By carrying out by repeating these steps, a circuit pattern is formed on a wafer multiplex.

[0021]If the production method of this example is used, the device which is the degree of high integration for which manufacture was difficult can be conventionally manufactured to low cost.

[0022]

[Effect of the Invention]Since the position of the SMIF indexer is made mostly in agreement [ height when taking out reticle from a pod ] with a reticle conveyance face according to this invention as mentioned above, The course which conveys the reticle taken out from the pod to a PURIARAIMENTO stage serves as the shortest, and while being able to make reticle replacement time into the shortest, contamination of the reticle under conveyance is also made to the minimum. Since the carrying-in appearance position of the pod was established apart from the indexer, the height can be made into desired height. Therefore, for example, if height shall be about 900 mm, the pod exchange by an operator and the correspondence to floor run AGV will also become easy. A pod conveying path is covered with covering, since it is separable with the pure environment and clean room environment in a semiconductor manufacturing device by exhausting an inside, raising dust preventive measures become unnecessary at a pod conveyer style, and a device can be manufactured cheaply.

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[Translation done.]

* NOTICES *



## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a bird's-eye view of the whole semiconductor aligner concerning one example of this invention.
[Drawing 2]It is a top view of the device of drawing 1.
[Drawing 3]It is a sectional view of the device of drawing 1.
[Drawing 4]It is a flow chart which shows the operation at the time of the pod load in the device of drawing 1.
[Drawing 5]It is a flow chart which shows the operation at the time of pod unloading in the device of drawing 1.
[Drawing 6]It is a bird's-eye view of the conventional whole semiconductor aligner.
[Drawing 7]It is an important section expanded sectional view of the device of drawing 6.
[Drawing 8]It is a figure showing the flow of manufacture of a minute device.
[Drawing 9]It is a figure showing the detailed flow of the wafer process in drawing 8.
[Description of Notations]
An exposure device chamber, the SMIF indexer for 2:reticles, 2a : 1: A pod, A pod mounting base, 4:mounting base ascending and descending means, 5:robot hand, 6 : 3: A rise-and-fall horizontal migration means, Covering, a 7a:pod placing part door, 8:gage pin, 9 : 7: A guide pin, The first existence detection sensor, a 10a:pin, 10b:flat spring, 10c : 10: A photo interrupter, 11: ID reading means and 12(a [ 12 ], 12b): -- the -- the existence detection sensor of two, a 101:exposure device chamber, a 102:pod, and 102a: -- a cassette, 102b: reticle, a 103:SMIF indexer, a 104:hand, and a 105:transportation means.

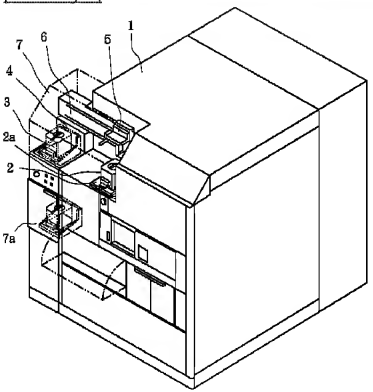
[Translation done.]

* NOTICES *

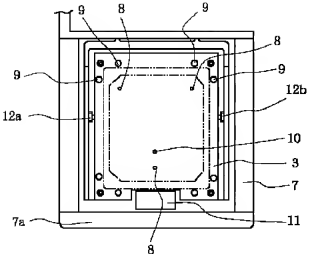


## DRAWINGS

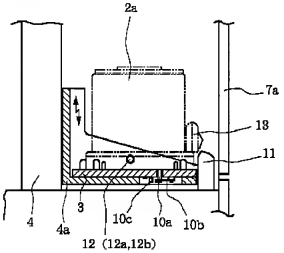
[Drawing 1]




[Drawing 2]




[Drawing 3]

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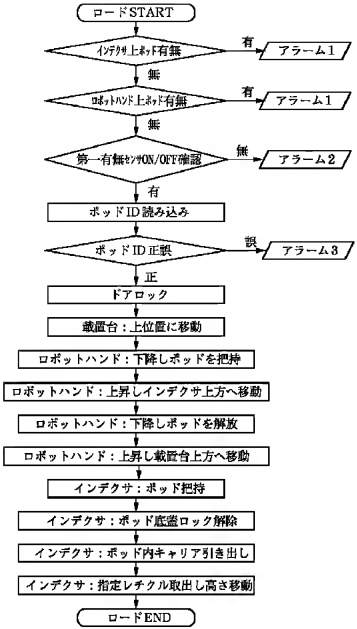
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誤
アラーム3
正
ドアロック
載置台：上位置に移動
ロボットハンド：下降しポッドを把持
ロボットハンド：上昇しインデクサ上方へ移動
ロボットハンド：下降しポッドを解放
ロボットハンド：上昇し載置台上方へ移動
インデクサ：ポッド把持
インデクサ：ポッド底盤ロック解除
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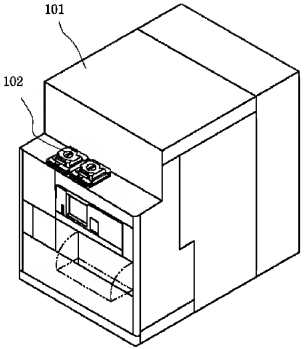
[Drawing 6]

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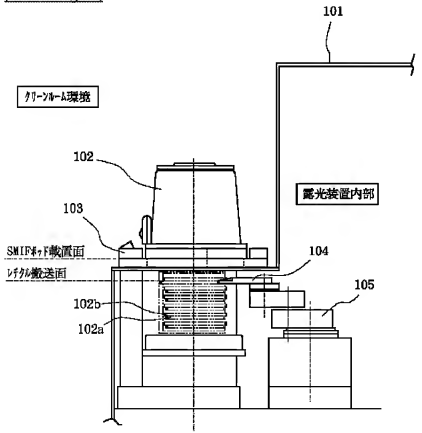


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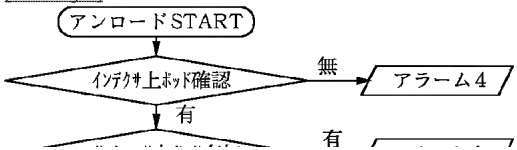

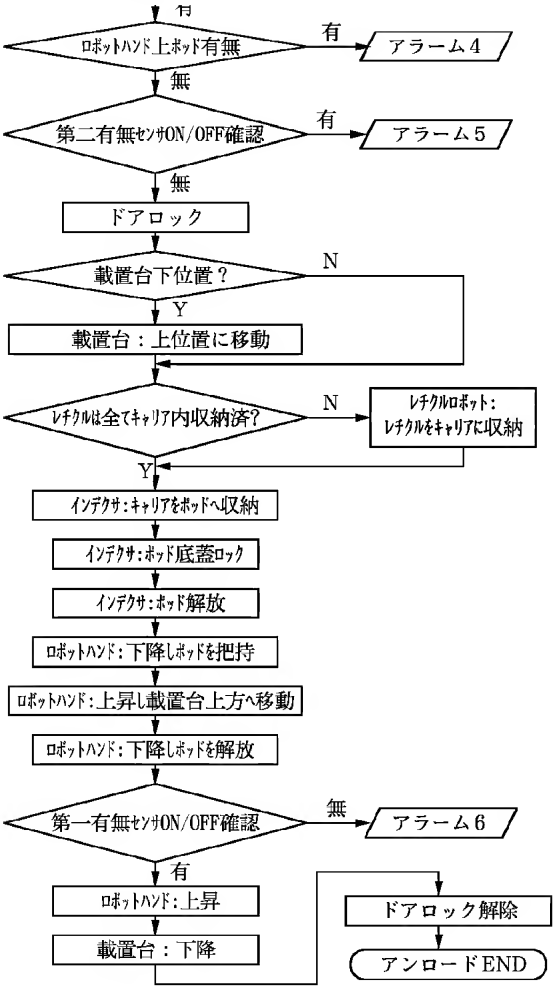
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載置台：上位置に移動
レチクルは全てキャリア内収納済?
N
レチクルロボット:
レチクルをキャリアに収納
Y
インデクサ:キャリアをポッドへ収納
インデクサ:ポッド底蓋ロック
インデクサ:ポッド解放
ロボットハンド:下降しポッドを把持
ロボットハンド:上昇し載置台上方へ移動
ロボットハンド:下降しポッドを解放
第一有無センサON/OFF確認
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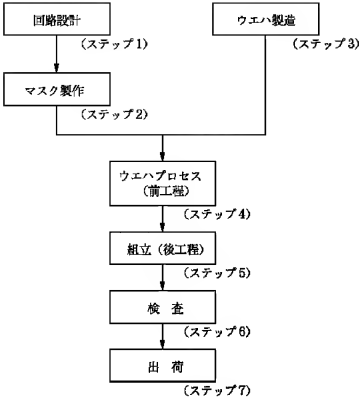
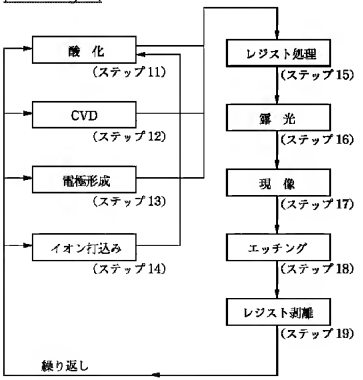
アンロードEND

[Drawing 8]




半導体デバイス製造フロー

[Drawing 9]




ウエハプロセス

[Translation done.]